**Title: Walking on Air**

**Brief Overview:**

Students will use graphing calculators to compile information and to explore various statistical measures.

**Links to Standards:**

• **Mathematics as Problem Solving**
Students will use a real-life problem to demonstrate their abilities to interpret, analyze, and draw conclusions from collected data and graphs.

• **Mathematics as Communication**
Each group will compile their data, and the class will submit to the company's CEO a written report stating their findings.

• **Mathematics as Reasoning**
Students will explore the most appropriate graphs to display their data, compare different graphs, and make predictions based upon data analysis.

• **Mathematical Connections**
Students will use technology and statistics to solve a real- life business problem.

• **Algebra**
Students will develop and use linear equations to determine different profit levels.

• **Statistics**
Students will organize the data, will calculate the mean, median, and mode, and will graph the data in order to help the company facilitate business decisions.

**Links to Maryland High School Mathematics Core Learning Goals:**

• **1.1.2:** The student will represent patterns and functional relationships in a table, as a graph, and/or by mathematical expression.

• **1.2.1:** The student will determine the equation for a line, solve linear equations, and describe the solutions using numbers, symbols, and graphs.

• **3.1.1:** The student will design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.

• **3.1.2:** The student will use the measures of central tendency and variability to make informed conclusions.

• **3.2.1:** The student will make informed decisions and predictions based upon the results of simulations and data from research.

**Grade/Level:**

Grades 9 and 10, Algebra I

### Duration/Length

Five 45- minute periods

### Prerequisite Knowledge:

Students should know how to do the following:

- Use the TI-82 calculator
- Given a set a data, compute the mean, median, mode
- Given a set of data, construct a histogram, box and whisker plots, and scatter plots

### Objectives:

Students will:

- work cooperatively in pairs.
- collect and organize raw data.
- use graphing calculators to organize, graph, and interpret a set of data.
- write a written report based on statistical findings.
- use an algebraic equation to  explore the most feasible way to find the break- even point and profit .

### Materials/Resources/Printed Materials:

- TI-82 calculator for each group
- Individual sets of activity sheets
- Student survey sheets
- Overhead projector
- Graphing calculator view screen
- Class summary database sheet

### Development/Procedures:

- The teacher will explain to the class an overview of what marketing information is needed by the company and the benefits that the school will receive.

- Students will receive survey forms to obtain raw data.

- Students will work in pairs or small groups and complete Activity #1 work sheet, while the teacher monitors the students' progress.

- After each activity work sheet, the teacher will lead students in further discussions and explanations and will compare group responses.

- When using the TI-82 calculators, the teacher will briefly review the statistical and graphing functions.

- After Activity #2, the teacher will solicit data from each group and complete the Class Cost Data Summary  Sheet for males and females. The results should be compared, analyzed and discussed with the class.

- In Activity #3, the teacher will assist students in developing an equation verbally, algebraically, and graphically.

- Once an equation is developed, students will use different prices in the equation to notice different outcomes.

## Performance Assessment:

- The teacher will circulate around the class acting as a resource.
- Group evaluation will be based on completion of group activity sheets and presentation.
- Individual evaluation will be based on written reports and activity sheets.

## Extension/Follow Up:

Students will create their own teacher-approved project. They will collect their own data. The students should use the TI-82 calculator to produce a variety of statistical measures on this data. Finally, the students should use this information to make conclusions and write a report predicting trends and patterns.

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# Athletic Shoe Survey Form

ABC Tennis Shoe Company wants to create a partnership with your school, however they need some raw data and your math class has been randomly selected for the job.  Each student will need to survey at least ten different people in order to obtain the information needed on shoe size, cost, and gender.  One line should be completed for each athletic shoe purchased in the past year.

Male _____      Female _____

| Shoe Number | Shoe Size | Cost |
|---|---|---|
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Activity Sheet #1
## Shoe Size

1.  Separate your surveys into two stacks, one for males and the other for females.

2.  Using a TI-82,
    *   enter the male shoe size data into List 1. <STAT EDIT>
    *   enter the female shoe size data into List 4. <STAT EDIT>

3.  Perform 1-Var Stats <STAT CALC> and complete.

    Male   shoe   size          Female shoe size
    Mean _____              Mean _____
    Median _____          Median _____

Which statistical measure do you feel is the best indicator for this set of data? Justify your answer ._____
_____
_____
_____

4. Sort the size data in List 1 and List 4 into ascending order. <STAT EDIT> Count the number of occurrences of each shoe size and store this count in List 2 and List 5.  Delete the duplicate shoe sizes as needed.

    What is the mode  shoe size for Males? _____
    What is the mode  shoe size for Females? _____

Consider  your answer for question 3.  Which statistical measure do you now think is the most appropriate description for this set of data? Why?_____
_____
_____

5.  In <STAT PLOT> explore the graphic choices for the data.  Remember to check your WINDOW to get the best picture.  Decide which graph you think provides the best representation for this data and copy the graph below for the Male and the Female data.

Male Shoe Size
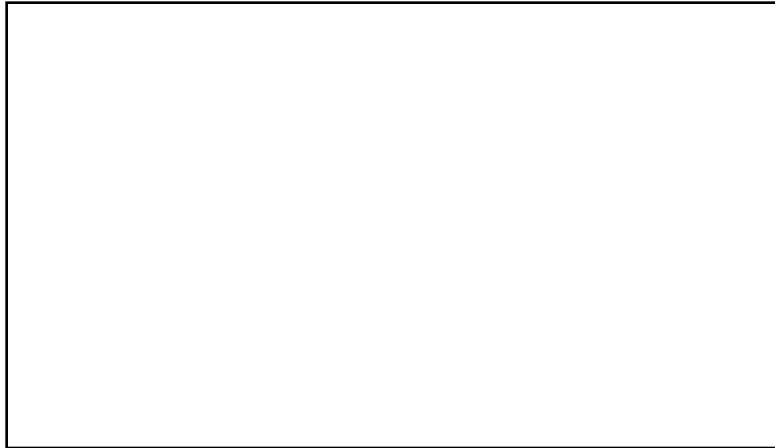
Female Shoe Size

6.  What do the graphs tell you about the shoe sizes? _____
_____
_____

7.  If a Women's size 9 shoe is identical to a Men's size 7 1/2, and every other size follows this correspondence, how does the Women's graph compare to the Men's?_____

_____

_____

8.  If you were placing an order for 200 pairs of a new style athletic shoe, how could you use your graphs to determine how many of each size to purchase? _____

_____

_____

9.  On a separate sheet of paper, write a memo (a paragraph or two) to a local shoe store advising them on how they should place their orders for this new shoe. Support your reasons with the statistics and graphs you have explored.

# Male
## Class Cost Data Summary Sheet

| Cost | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Class Totals |
|------|---|---|---|---|---|---|---|---|--------------|
| 0-$9.99 | | | | | | | | | |
| $10-$19.99 | | | | | | | | | |
| $20-29.99 | | | | | | | | | |
| $30-$39.99 | | | | | | | | | |
| $40-49.99 | | | | | | | | | |
| $50-$59.99 | | | | | | | | | |
| $60-$69.99 | | | | | | | | | |
| $70-$79.99 | | | | | | | | | |
| $80-$89.99 | | | | | | | | | |
| $90-$99.99 | | | | | | | | | |
| $100-109.99 | | | | | | | | | |

# Female
## Class Cost Data Summary Sheet

| Cost | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Class Totals |
|------|---|---|---|---|---|---|---|---|--------------|
| 0-$9.99 | | | | | | | | | |
| $10-$19.99 | | | | | | | | | |
| $20-29.99 | | | | | | | | | |
| $30-$39.99 | | | | | | | | | |
| $40-49.99 | | | | | | | | | |
| $50-$59.99 | | | | | | | | | |
| $60-$69.99 | | | | | | | | | |
| $70-$79.99 | | | | | | | | | |
| $80-$89.99 | | | | | | | | | |
| $90-$99.99 | | | | | | | | | |
| $100-109.99 | | | | | | | | | |

# Activity Sheet #2
## Shoe Cost

1.  Separate your surveys into two stacks, one for males and the other for females.

2.  Using a TI-82,
    *   clear the calculator memory and reset   the default values <MEM 5>
    *   enter the male shoe cost data into List 1. <STAT EDIT>
    *   enter the female shoe cost data into List 4. <STAT EDIT>

3.  Perform 1-Var Stats <STAT CALC> and complete.

    Male  shoe  cost               Female shoe cost
    Mean _____                   Mean _____
    Median _____               Median _____

Which statistical measure do you feel is the best indicator for this set of data? Justify your answer ._____
_____
_____
_____

4. Sort the cost data in List 1 and List 4 into ascending order. <STAT EDIT>.  Now  List 1 needs to be displayed in a histogram to see the breakdown of the number of shoes purchased in certain price ranges.  Set the window to match the following:

    xmin = 0
    xmax = 110
    xscl=10
    ymin=0
    ymax=20 (may need to be adjusted depending upon your data)
    yscl=2
    xres=1

5.  Trace the histogram and record the counts of items within each price range.

Male Cost Data

| Cost | Count |
|---|---|
| 0-$9.99 | _____ |
| $10-$19.99 | _____ |
| $20-$29.99 | _____ |
| $30-$39.99 | _____ |
| $40-$49.99 | _____ |
| $50_$59.99 | _____ |
| $60-$69.99 | _____ |
| $70-$79.99 | _____ |
| $80-$89.99 | _____ |
| $90-$99.99 | _____ |
| $100-$109.99 | _____ |

6.  What is the most frequently used price range? _____

7.  Your teacher has a  Male Class Cost Data Summary Sheet.  Record you group's results from question 5.

8.  Display List 4, Female data, in a histogram and record the counts of items within each price range.

Female Cost Data

| Cost | Count |
|---|---|
| 0-$9.99 | _____ |
| $10-$19.99 | _____ |
| $20-$29.99 | _____ |
| $30-$39.99 | _____ |
| $40-$49.99 | _____ |
| $50_$59.99 | _____ |
| $60-$69.99 | _____ |
| $70-$79.99 | _____ |
| $80-$89.99 | _____ |
| $90-$99.99 | _____ |
| $100-$109.99 | _____ |

9.  What is the most frequently used price range? _____

10.  Your teacher has a  Female Class Cost Data Summary Sheet.  Record you group's results from question 8.

11.  In a paragraph, compare and contrast the male and female results. What does your group feel the optimum price should be for a pair of tennis shoes?

# Activity Sheet #3

- Work with a partner.

- In return for this marketing information, the company agrees to give the school 20% of its profits for the year, based on units sold.  The company is introducing a new line of shoes.   The company provides you with the following information:
  - Unit price wholesale cost    $15.00 per pair of shoes
  - Total operating costs    $8000.00 per month.  Your task is to determine:

A.  As a class, determine a fair price the consumer would pay for this new shoe.  How many shoes must be sold this month to cover expenses? What happens if you use your minimum price?  Your maximum price? Which price is the best choice?

_____

_____

_____

B.  The school's Activity Committee has determined that $3000.00 is needed for field trips next year.  How many shoes must be sold in order for the school to receive $3000.00?

_____

_____

_____

C.  Using the price you chose in (A), formulate an equation that will give you the 20% profit.  How many shoes need to be sold to net the $3000.00 for field trips?

_____

_____

_____